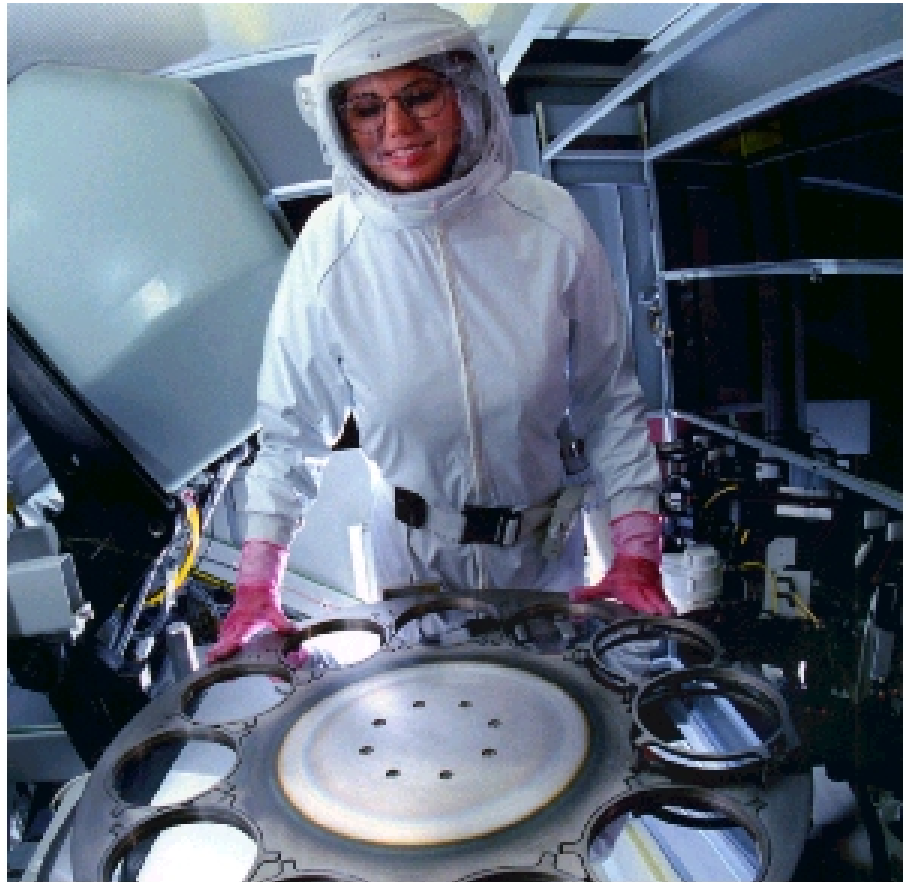




SANDIA TO RADIATION HARDEN INTEL'S "CROWN JEWEL" PENTIUM® PROCESSOR FOR SPACE AND DEFENSE NEEDS

INTEL PROVIDES NO-FEE LICENSE TO A GRATEFUL U.S. GOVERNMENT

Intel Corp. will provide a no-fee license for its Pentium® processor design to DOE's Sandia National Laboratories for the development of custom made microprocessors for U.S. space and defense purposes. The agreement saves U.S. taxpayers hundreds of millions of dollars in microprocessor design costs and provides the federal government with a 10-fold increase in processing power over the highest performing rad-hard chips in use today. Intel's generous gift comes at a time when the rapid pace of design innovation for commercial integrated circuit applications, such as personal computers, has outdistanced the budgetary ability of military and space designers to design comparable performance integrated circuits for radiation environments.



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Radiation hardening has been called both a science and an art. Many microelectronics experts worldwide have long considered this expertise to be synonymous with Sandia National Laboratories. Here, a Sandia technician displays a plenum of one of several metal deposition systems used for radiation-hardened microelectronics processing at Sandia.



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.



The Department of Energy (DOE) announced today (Dec. 8) that Intel will provide a no-fee license for its Pentium® processor design to DOE's Sandia National Laboratories for the development of custom made microprocessors for US space and defense purposes. The agreement saves US taxpayers hundreds of millions of dollars in microprocessor design costs and provides the federal government with a 10-fold increase in processing power over the highest performing existing technology. In a ceremony attended today at Intel's Santa Clara, Calif., headquarters by Secretary of Energy Bill Richardson, NASA Administrator Daniel Goldin and others, Intel said it would license the design to Sandia, DOE's lead lab for microelectronics research and development. Sandia will develop a custom, radiation-hardened version of the Pentium processor for use in satellites, space vehicles, and defense systems. Radiation hardening is required to "immunize" systems and applications from radiation, such as cosmic rays, which affect the reliability of conventional electronics.

"The Pentium processor design will offer tremendous performance, flexibility, and reliability for critical government applications," said Craig Barrett, Intel President and chief executive officer. "This agreement allows the government to apply the vast research and development activity that Intel has undertaken for the commercial market to its mission-critical needs."

"The five generations of chips that Sandia has hardened have been essential elements in earth satellites, the Galileo mission, missiles, nuclear weapons, and in other applications where radiation degrades both the performance and reliability of conventional electronics," said Sandia Executive Vice President John Crawford.

"DOE and Sandia are proud to be partnering with Intel, NASA, the Air Force Research Lab, and the National Reconnaissance Office to produce a rad-hard version of the Pentium. If we had to pay to license the Pentium technology, government costs would go up considerably."

The Pentium processor is one of the most popular computer chips in the world. Developed by Intel at an estimated cost of more than \$1 billion, it can run more software—including applications, development tools, and diagnostic tools—than any other chip ever designed. Intel cofounder Gordon Moore, who also directed the transfer of the first Intel microprocessor designs to Sandia more than 18 years ago.

NEW INTEL/SANDIA AGREEMENT IS THE LATEST IN A LONG-TERM PARTNERSHIP

This new agreement with Intel is the latest in a long series of Sandia and Intel partnerships, says Bob Blewer, Deputy Director of Sandia's Microelectronics S&T and Components Center. Bob is in charge of strategic partnerships for the center, including Sandia's five-year-old microelectronics cooperative research and development agreement (CRADA) with Intel, from which the current opportunity sprang.

Bob says the new Pentium design transfer is possible because Sandia has achieved a high level of technical credibility with Intel in the course of successfully executing more than 60 projects under that CRADA and has shown that it can protect Intel's intellectual property during previous microprocessor design transfers.

Bob says this level of credibility and trust is extremely important to Intel, which has an investment of more than \$1 billion in the Pentium design, the crown jewel of Intel's success in recent years.

The Pentium transfer is the third chip design transferred from Intel to Sandia over the last 18 years and is part of a long-term cooperative relationship.

Sandia and Intel have worked together on numerous mutually beneficial projects over a period of years. In addition to the chip design transfer, they include massively parallel computer development, the Extreme Ultraviolet Lithography program, and about 60 smaller projects over the years.

Intel built the world's first teraflops (one-trillion-operations-per-second) computer—the fastest in the world at the time—for Sandia under government contract in 1995.

The Department of Energy has long been Sandia's primary source of financial support. Now three more federal groups are providing financial support for Sandia's radiation-hardened Pentium® project: NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif.; the National Reconnaissance Office (NRO) in Chantilly, Va.; and the Air Force Research Laboratory (AFRL) in Dayton, Ohio (AFRL's Space Vehicles Directorate is located on Kirtland AFB in Albuquerque). Officials of all three groups enthusiastically support the agreement that allows Sandia to redesign and redevelop Intel's Pentium processor .

NASA Administrator Dan Goldin said Intel's no-fee license to the government will let NASA exploit Intel's already developed technology. Otherwise, he noted, "We would not be spending money on what we should be doing—long term, high-risk research." He noted that in the next five to 10 years, NASA will be exploring the under-ice oceans on Europa (one of Jupiter's moons), bringing back samples from Mars, and sending spacecraft to the outer limits of our solar system. He emphasized that the damaging radiation in places like Jupiter is "incredible" and that the rad-hard Pentium will be a major help in a space environment that is "unbelievably unforgiving."

JPL Director Ed Stone said the new rad-hard chip will serve well in NASA's Deep Space Systems Technology Development Program, known as X2000: "The successful development of this new chip will bring advanced computing capability to our mission in deep space where the radiation environment is much too severe for commercial devices," he said.

Head of JPL's Center for Integrated Space Microsystems Leon Alkalai noted that high-performance rad-hard processors such as the rad-hard Pentium will also be useful in future Earth-orbiting missions: "This technology is cross cutting within all of NASA's enterprises, including space science, Earth science, aeronautics, and human exploration and development of space."

NRO Director Keith Hall emphasized the efficiency that will be gained by all government groups working closely together and with industry: "This is another example of the NRO working to push the technology envelope while working with our partners in government and industry to do so more efficiently and cost effectively."

The **AFRL's Maj. Gen. Dick Paul** said, "We are proud to be a member of this nationally recognized team of space technology specialist working together to develop high-performance processors for next-generation spacecraft."

NASA/JPL, the NRO, and the AFRL have committed to four years of financial support for the program, totaling about \$16 million. This figure does not include DOE's continuing support for Sandia's microelectronics program. Other external users of rad-hard chips have already inquired about joining this effort and may ask Sandia to explore specialized applications for the rad-hard Pentium.

Among the national laboratories, only Sandia has both the design and the microelectronics fabrication infrastructure to attempt a project as complex as redesigning and manufacturing a Pentium-class chip with radiation-hardened characteristics. Sandia combines a detailed understanding of the art and science of manufacturing radiation-hardened chips with a working knowledge of the modern microelectronics industry obtained through numerous partnerships with leading-edge US microelectronics companies.

"We're proud to be a part of this unique opportunity to partner with Intel to significantly advance the state of the art in space and defense electronics. This is a precedent-setting show of cooperation, in which the taxpayers are among the biggest winners."

Bill Richardson Secretary of Energy

The Pentium processor redesign effort will involve several government agencies that are expected to use the increased computing power for a variety of applications. DOE, NASA's Jet Propulsion Laboratory (JPL), the Air Force Research Laboratory (AFRL), and the National Reconnaissance Office (NRO) are the initial agencies with projects identified. Some of the applications will include earth satellites, space probes, missile defense, and other advanced military systems.

Prototypes of the custom chips will be fabricated and tested in small volumes at Sandia's Albuquerque, N.M., Microelectronics Development Laboratory. For production of larger quantities, Sandia will actively seek,

through an announcement in the federal Commerce Business Daily, the participation of specialty commercial suppliers that traditionally serve the rad-hard integrated circuit needs of defense or space-related markets.

Suppliers who choose to participate in manufacturing the rad-hard Pentium for government use will

“This partnership highlights the tremendous benefits that accrue to the taxpayers, as well as to private industry, when partnerships are used to leverage the resources of each party.” *Sen. Pete Domenici (R-N.M.)*

receive masks and manufacturing instructions at no cost.

*This story and sidebars were abstracted from Larry Perrine’s longer story by the same title that appeared in the **Sandia Lab News** on December 18, 1998.*